Product Catalog 10

GPS & Wireless solutions 2009

locate, communicate, accelerate
Dear valued customers and partners,

The recent months have been a very exciting time for all of us at u-blox as the company enters into new strategic markets with attractive products, technologies and new alliances. In particular, our decision to establish core competencies in GSM and 3G technologies in addition to our industry-leading GPS expertise allows us to serve our customers’ increasing demands for embedded global positioning solutions and mobile connectivity.

This strategy is supported by the acquisition of Neonseven, an established center of excellence for design, software, integration and testing of GSM and 3G technologies. This alliance gives u-blox enormous know-how and intellectual property in wireless communications which has already produced first positive results: the market launch of LEON, the first GSM/GPRS surface-mount module from u-blox.

On the consumer GPS side, we have strengthened our know-how and product range with the addition of sophisticated Geotagging products and technologies. Through the acquisition of Geotate, and its patented GPS Capture & Process technology, u-blox now offers exciting geotagging solutions for portable consumer devices, especially cameras, where fast GPS signal capture and lowest power consumption are critical for optimal user experience. Our Capture & Process technology is now available in two products:

- **YUMA** embedded geotagging solution for cameras.
- **KATO** solution for camera geotagging accessories.

In addition to acquisitions, we have made significant innovative improvements to our core GPS product line to address important new market requirements.

- **The market introduction of AMY-5M**, the world’s smallest stand-alone GPS module. At just 6.5 x 8 x 1.2 millimeters, AMY can be easily integrated into small profile products such as wristwatches, mobile phones, PDAs and USB sticks.
- **Introduction of new off-the-shelf GPS PCI Express cards PCM-5S and PCM-5S**, enabling next-generation laptop, netbook, mobile internet devices and “Ultra Mobile” PC OEMs to provide GPS and location-based services.

At u-blox, we strongly believe that rapid technological innovation and expansion of our core competencies into complementary technologies is key to our growth and success. Through organic growth and strategic acquisitions, we are now in our strongest position ever to address a wider spectrum of embedded GPS as well as wireless communications markets on a global scale.

Thank you for allowing me to communicate our position, we look forward to doing business with you.

Thomas Seiler - CEO u-blox
u-blox is a fabless semiconductor provider of embedded positioning and wireless communication solutions for the consumer, industrial and automotive markets. The company's solutions enable people, devices and machines to locate and communicate their exact position.

With a broad portfolio of chips, modules, software and design services, u-blox is uniquely positioned to enable its OEM customers to develop feature-rich and innovative solutions quickly and cost-effectively.

**Global presence**

Our global presence ensures that we can react quickly to changing customer demands. It also puts us in a stronger position to share knowledge and market requirements with our customers.

With our staff of 180 people worldwide, we are able to support our customers from the very beginning right through to product design and final production set-up. u-blox is headquartered in Switzerland and has offices in Italy, UK, the USA, Singapore, Hong Kong, China, Taiwan, Korea and Japan.

**Key facts**

<table>
<thead>
<tr>
<th>Foundation</th>
<th>Founded in 1997, Switzerland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock exchange listing</td>
<td>Listed on the SIX Swiss Exchange</td>
</tr>
<tr>
<td>Employees</td>
<td>Approximately 180</td>
</tr>
<tr>
<td>Sales</td>
<td>2008 revenue of CHF 74.5 million (approximately USD 68.4 million)</td>
</tr>
<tr>
<td>Markets served</td>
<td>Consumer, Industrial and Automotive</td>
</tr>
<tr>
<td>Market penetration</td>
<td>More than 1'000 customers worldwide benefit from our solutions</td>
</tr>
<tr>
<td></td>
<td>More than 10'000 devices rely on our solutions</td>
</tr>
<tr>
<td></td>
<td>More than 10'000'000 people and machines utilize our solutions</td>
</tr>
</tbody>
</table>
u-blox’ powerful range of GPS & GALILEO receiver chips and chipsets are ideal for consumer as well as automotive applications. All products are designed for maximum sensitivity, cost-effectiveness as well as compatibility with both GPS and Galileo satellite navigation standards.
Read more on page 30.

u-blox’ advanced, tested, off-the-shelf GPS & GALILEO receiver modules provide an easy-to-implement solution to add satellite navigation capability to end-products quickly and cost-effectively. u-blox’ surface-mount GPS receiver modules are ideal for consumer, industrial and automotive applications. All products are designed for maximum sensitivity, small size, low-power consumption and cost-effectiveness.
Read more on page 12.

u-blox offers geotagging products focused on low-power solutions for portable consumer devices such as cameras. Based on a patented “Capture & Process” technology, the solution facilitates labelling of all kinds of digital media with the location where it was captured.
Read more on page 34.

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Read more on page 34.

u-blox now offers wireless surface-mount transceiver modules based on the GSM/GPRS mobile communications standard. As a stand-alone GSM module or in conjunction with u-blox’ GPS receiver modules, our GSM modules are optimized for mass market and professional GPS/wireless applications requiring mobile connectivity such as asset tracking, fleet management, vehicle recovery and mobile emergency services.
Read more on page 40.

u-blox licenses complete, tested, off-the-shelf reference designs for embedded wireless modules ready to be integrated into OEM end-products and mass produced. u-blox’ wireless solutions support GSM/GPRS, EDGE and HSPA standards.
Read more on page 44.

For more detailed information, please visit our website at www.u-blox.com or contact our regional sales offices.
Personal navigation
Embedded in mobile phones, personal navigation devices (PNDs), ultra-mobile PCs and watches, our GPS and wireless solutions do much more than guide you to your destination; they can help you find your friends, your car, useful services and points of interest that are relevant to where you are, and where you are going.

Geotagging photos and videos
u-blox’ patented GPS Capture & Process technology gives camera manufacturers a quick and easy way to add point-and-shoot geotagging capabilities to cameras and accessories. Our geotagging solution enables photographers to easily find, manage and share their photos and videos based on where they were created.

Portable GPS for tracking and recreational products
Our products are used in a growing range of handheld tracking and recreational devices such as child and pet locator, golf range-finder, jogging, marine and fishing equipment. Whether for fun or for safety, u-blox’ highly-integrated, ultra-sensitive GPS and GSM modules, cards, chipsets, and software enable consumer devices to keep you aware of the world around you, no matter where you are.

“We chose u-blox for their high performance GPS engine and experience, and integrated u-blox specific receiver algorithms which culminated in TruePoint™ precision GPS. This new technology, when used in combination with our high-precision golf course maps, gives golfers yet another level of accuracy improvement they need to play smarter, faster and have more fun.”

Richard Edmonson, CEO at SkyGolf
Industrial Fleet management and asset tracking
Keeping accurate track of valuable assets via GPS streamlines your supply chain. Whether for fleet management, vehicle recovery, locating people or shipments, u-blox has the right embedded GPS and wireless modules that combine high-sensitivity, small size and low power consumption with industrial temperature range. u-blox’ asset tracking solutions let you combine GPS positioning with the power to communicate over the world’s largest mobile network.

Remote monitoring and control
Our embedded GSM solutions support a diverse range of machine-to-machine applications such as remote automation and control, remote metering, security systems, and vending equipment monitoring.

Precision timing
Our GPS technology provides a precision reference clock accurate to 15 billionth of a second to support time-critical applications such as synchronization of distributed computer systems and mobile base-stations.

“...We knew the challenges of the dense urban canyon of Manhattan and went to great lengths to source the best available position and location technology. When sourcing a GPS receiver, we selected u-blox’ LEA-4R dead reckoning GPS module for its unmatched reliability, accuracy and ease of integration.”

Kevin French, Chief Operating Officer at Mobile Knowledge

Automotive GPS & GSM is at the heart of new in-vehicle services
GPS navigation is a standard feature in today’s cars. But getting you where you want to go is just the beginning. u-blox’ robust GPS and GSM technologies allow designers to put a whole new array of helpful, entertaining as well as emergency services at the driver’s fingertips. Features such as automated trip advisor wirelessly downloads details about your surroundings to inform you of up-to-the-minute traffic and parking conditions, special attractions, hotels, service stations and restaurants along your route. Assistance is automatically summoned via GSM in the event of an accident, emergency or breakdown.

Vehicle recovery and automotive “black-box” based on GPS
The ability to recover stolen vehicles is becoming a hot global issue. u-blox’ ultra-small, yet highly sensitive GPS solutions combined with GSM connectivity provides the perfect solution to this growing problem. Additionally, in-vehicle GPS can also be used to record location, speeds, and acceleration for use in “crash-logging”. When chosen as an option, this feature can dramatically reduce insurance costs to the driver.

“...u-blox’ long-term roadmap of pin-to-pin compatible modules enabled us to quickly and easily integrate the LEA-5S as soon as it became available. This enabled us to introduce our products into the market at record speed, benefiting from all the technological advances of the u-blox 5 engine without having to redesign our PCBs.”

Simone Lazzarini, AvMap CEO.
Embedded products for global positioning and wireless communications

u-blox provides highly integrated solutions for embedded GPS and GSM applications. Our market-proven products can be found in demanding automotive and industrial environments, as well as in mobile and handheld consumer devices where size and power consumption is critical. Combining industry-leading sensitivity with innovative features and packaging, u-blox products are designed to meet our customer’s stringent requirements. Whether as chips, GPS or GSM modules, cards or complete GPS solutions, we offer the right product with the right performance to suit your design.

<table>
<thead>
<tr>
<th>Product portfolio</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS modules</td>
<td>AMY: World’s smallest GPS module</td>
</tr>
<tr>
<td></td>
<td>NEO: World’s first 1.8 Volt GPS modules</td>
</tr>
<tr>
<td></td>
<td>LEA: GPS &amp; GALILEO modules with optional flash</td>
</tr>
<tr>
<td></td>
<td>TIM: GPS &amp; GALILEO modules with optional flash</td>
</tr>
<tr>
<td>GPS cards</td>
<td>PCM: GPS half-mini card for mobile computers</td>
</tr>
<tr>
<td></td>
<td>PCI: GPS mini card for mobile computers</td>
</tr>
<tr>
<td>GPS chips</td>
<td>Single chip: Standard and automotive grades</td>
</tr>
<tr>
<td></td>
<td>Chipset: Standard and automotive grades</td>
</tr>
<tr>
<td>GPS solutions</td>
<td>YUMA: Capture &amp; Process for cameras</td>
</tr>
<tr>
<td></td>
<td>KATO: Capture &amp; Process for camera accessories</td>
</tr>
<tr>
<td></td>
<td>AssistNow: Free A-GPS services</td>
</tr>
<tr>
<td>Wireless modules</td>
<td>LEON: GSM/GPRS transceiver module</td>
</tr>
<tr>
<td>Wireless solutions</td>
<td>Reference designs: For embedded wireless communications</td>
</tr>
</tbody>
</table>
Overview

Based on a proprietary high-performance architecture with 50 parallel channels and 1 million effective correlators, u-blox’ powerful range of GPS receiver modules is ideal for consumer and industrial applications. u-blox’ advanced, thoroughly qualified and 100% tested GPS receiver modules provide an easy-to-implement solution to add satellite navigation capability to end-products quickly and cost-effectively.

Key benefits include

- Small footprint for compact designs: ideal for applications with strict cost and space constraints
- Simple low-cost mounting:
  - Surface-mount pads are on only two sides of the package resulting in simple and low-cost PCB mounting
- Ultra-fast acquisition time: Time To First Fix (TTFF) of less than 1 second with KickStart
- World’s highest GPS sensitivity: down to ~160 dBm based on u-blox’ industry-leading SuperSense® technology
- Flexible, low operating voltage: 1.8 V or 3.0 V operation
- Jamming immunity:
  - Noise suppression architecture allows embedding in computers, mobile phones, PDAs, industrial and automotive electronics
- Built-in antenna supervisor supports external and active antennas
- GPS and GALILEO ready
- Fast time-to-market: reference designs and evaluation tools minimize design-in time

Product selector: u-blox 5 modules

<table>
<thead>
<tr>
<th>Series</th>
<th>Power</th>
<th>Size</th>
<th>Technology</th>
<th>Interface</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMY-SM</td>
<td>1.75 - 2.0</td>
<td>1.2</td>
<td>*</td>
<td>*</td>
<td>1</td>
</tr>
<tr>
<td>NEO-SD</td>
<td>1.75 - 2.0</td>
<td>2.4</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>NEO-SQ</td>
<td>1.75 - 2.0</td>
<td>2.4</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>LEA-SA</td>
<td>2.7 - 3.6</td>
<td>3.0</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>LEA-SQ</td>
<td>2.7 - 3.6</td>
<td>3.0</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>LEA-ST</td>
<td>2.7 - 3.6</td>
<td>3.0</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>TIM-SH</td>
<td>2.7 - 3.6</td>
<td>3.0</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

Our easy to integrate modules are the ideal choice for coping with tight time-to-market constraints or limited development budgets. Our modules are 100% tested, stand-alone receivers, which means that all additional electronic elements on the printed circuit board have been tested and optimized for best GPS receiver performance, making u-blox modules the perfect cost efficient choice for low, medium and high volume projects.
AMY-5M
u-blox5 ROM-based GPS receiver

Product description
AMY-5M is the smallest standalone GPS receiver in the industry. This fully tested ROM-based solution features the high performance u-blox 5 positioning engine and has been specifically developed for easy implementation. AMY-5M is fully autonomous and requires no host integration, facilitating an extremely short time-to-market.

AMY-5M offers four different serial interfaces. The receiver features an integrated GPS crystal, providing fast acquisition and excellent tracking performance at a competitive price. In addition, AMY-5M can be assembled on a 2-layer PCB, which saves production costs.

Highlights
- Industry’s smallest GPS receiver module: 6.5 x 8 x 1.2 mm
- No additional components required
- No host integration required
- 50-channel u-blox 5 engine with 1 million correlators
- Operates at 1.8V and 3.0V
- Variety of interfaces: 1 UART, 1 USB, 1 DDC (I2C compliant), 1 SPI (planned)
- Assisted GPS supported

Block diagram

AMY-5M is so small that it can be integrated into the smallest portable devices. Advanced jamming suppression mechanisms and innovative RF architecture ensure maximum performance even in hostile signal environments.

Receiver performance data

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver type</td>
<td>50-channel u-blox5 engine</td>
</tr>
<tr>
<td>GPS L1 C/A code</td>
<td>SBAS, WAAS, EGNOS, MSAS, GAGAN</td>
</tr>
<tr>
<td>Max. update rate</td>
<td>4 Hz</td>
</tr>
<tr>
<td>Accuracy1</td>
<td>Position: 2.5 m CEP</td>
</tr>
<tr>
<td></td>
<td>Warm: 2.0 m CEP</td>
</tr>
<tr>
<td>Acquisition1</td>
<td>Cold starts: 32 s</td>
</tr>
<tr>
<td></td>
<td>Warm starts: 32 s</td>
</tr>
<tr>
<td></td>
<td>Aided starts: &lt; 1 s</td>
</tr>
<tr>
<td></td>
<td>Hot starts: &lt; 3 s</td>
</tr>
<tr>
<td>Sensitivity2</td>
<td>Tracking: –160 dBm</td>
</tr>
<tr>
<td></td>
<td>Reacquisition: –160 dBm</td>
</tr>
<tr>
<td></td>
<td>Cold starts: –143 dBm</td>
</tr>
<tr>
<td>A-GPS</td>
<td>Supports AssistNow Online and AssistNow Offline, OMA SUPL compliant</td>
</tr>
<tr>
<td>Operational limits</td>
<td>Velocity: 500 m/s (972 knots)</td>
</tr>
<tr>
<td></td>
<td>Altitude: 50,000 m</td>
</tr>
<tr>
<td>1</td>
<td>All 3Vb: –130 dBm</td>
</tr>
<tr>
<td>2</td>
<td>Dependent on aiding data connection speed and latency</td>
</tr>
<tr>
<td>3</td>
<td>Demonstrated with a good active antenna</td>
</tr>
</tbody>
</table>

Mechanical data

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing</td>
<td>LGA50</td>
</tr>
<tr>
<td>Dimensions</td>
<td>8.0 x 6.5 x 1.2 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>0.15 g</td>
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</tbody>
</table>

Electrical data

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltages</td>
<td>Single voltage supply:</td>
</tr>
<tr>
<td></td>
<td>1.75 – 2.0V or 2.5 – 3.6V</td>
</tr>
<tr>
<td></td>
<td>Dual voltage supply:</td>
</tr>
<tr>
<td></td>
<td>1.4V / 1.8V</td>
</tr>
<tr>
<td>Digital I/O</td>
<td>1.65 – 3.6V</td>
</tr>
<tr>
<td>Voltage level</td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>64 mW (tracking &amp; navigating)</td>
</tr>
<tr>
<td>Backup supply</td>
<td>Voltage range: 1.4 to 3.6V</td>
</tr>
<tr>
<td>Antenna supervision</td>
<td>Short and open circuit detection supported with external circuit</td>
</tr>
<tr>
<td>Antenna type</td>
<td>Active and passive</td>
</tr>
</tbody>
</table>

Interfaces

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial interfaces</td>
<td>1 UART</td>
</tr>
<tr>
<td></td>
<td>1 USB V2.0 full speed 12 Mbit/s</td>
</tr>
<tr>
<td></td>
<td>1 DDC (I2C compliant)</td>
</tr>
<tr>
<td></td>
<td>1 SPI (planned)</td>
</tr>
<tr>
<td>Digital I/O</td>
<td>Configurable time pulse</td>
</tr>
<tr>
<td></td>
<td>2 EXTI interrupt inputs</td>
</tr>
<tr>
<td></td>
<td>10 Configuration pins</td>
</tr>
<tr>
<td>Protocols</td>
<td>NMEA, UBX binary</td>
</tr>
</tbody>
</table>

Environmental data

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temp.</td>
<td>–40°C to 85°C</td>
</tr>
</tbody>
</table>

Ordering information

AMY-5M-0 ROM-based u-blox5 GPS module
Available as samples and tape on reel (2000 pieces)
NEO-5 module series
u-blox 5 ROM-based GPS receivers

Product description
The NEO-5 module series brings the high performance of the u-blox 5 positioning engine to the miniature NEO form factor. These receivers combine a high level of integration capability with flexible connectivity options in a small package. This makes them perfectly suited for mass-market end products with strict size and cost requirements.

Highlights
- 50-channel u-blox 5 engine with over 1 million effective correlators
- < 1 second Time-To-First-Fix for hot and aided starts
- –160 dBm SuperSense® acquisition and tracking sensitivity
- Accelerated startup at weak signals for modules with KickStart feature
- Supports AssistNow Online and AssistNow Offline A-GPS services; OMA SUPL compliant
- High immunity to jamming
- Up to 4 Hz position update rate
- Miniature 16.0 x 12.2 mm package
- UART, USB, DDC and SPI (planned) interfaces
- 1.8 V supply voltage for low power consumption
- RoHS compliant

Features

<table>
<thead>
<tr>
<th>Series</th>
<th>Power</th>
<th>Size</th>
<th>Memory</th>
<th>Function</th>
<th>Antenna</th>
<th>Input / Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEO-5M</td>
<td>2.7 - 3.6</td>
<td>2.4</td>
<td>P</td>
<td>Programmable Flash, F/W update</td>
<td>Power save mode</td>
<td>UART, USB, SR, DDC, SPI, (planned)</td>
</tr>
<tr>
<td>NEO-SQ</td>
<td>2.7 - 3.6</td>
<td>2.4</td>
<td>P</td>
<td>Programmable Flash, F/W update</td>
<td>Power save mode</td>
<td>UART, USB, SR, DDC, SPI, (planned)</td>
</tr>
<tr>
<td>NEO-SD</td>
<td>1.8</td>
<td>2.4</td>
<td>P</td>
<td></td>
<td></td>
<td>UART, USB, SR, DDC, SPI, (planned)</td>
</tr>
<tr>
<td>NEO-SG</td>
<td>1.8</td>
<td>2.4</td>
<td>P</td>
<td></td>
<td></td>
<td>UART, USB, SR, DDC, SPI, (planned)</td>
</tr>
</tbody>
</table>

Support products
u-blox5 Evaluation Kits
- EVK-SH with KickStart suitable for NEO-SG, NEO-SQ
- EVK-SP with SuperSense® for NEO-SD, NEO-SM

Ordering information
- NEO-5D: ROM-based u-blox 5 GPS Module 1.8V
- NEO-5G: ROM-based u-blox 5 GPS Module with KickStart, 1.8V
- NEO-5M: ROM-based u-blox 5 GPS Module 3V
- NEO-5Q: ROM-based u-blox 5 GPS Module with Kickstart

Available as samples and tape on reel (250 pieces)
LEA-5 module series
u-blox5 GPS and GALILEO receivers

Product description
The LEA-5 module series brings the high performance of the u-blox5 positioning engine to the industry standard LEO/LEA form factor. These versatile, stand-alone receivers combine an extensive array of features with flexible connectivity options. Their ease of integration results in fast times-to-market for a wide range of automotive, consumer and industrial applications with strict size and cost requirements.

Highlights
- 50-channel u-blox5 engine with over 1 million effective correlators
- < 1 second Time-To-First-Fix for hot and aided starts
- ~160 dBm SuperSense® sensitivity
- Accelerated startup at weak signals with KickStart feature
- Up to 3 serial interfaces: UART, USB, 1 DDC (I²C compliant). 1 SPI planned
- Supports AssistNow Online and AssistNow Offline A-GPS services; OMA SUPL compliant
- High immunity to jamming
- Hybrid GPS, GALILEO and SBAS (WAAS, EGNOS, MSAS, GAGAN) engine
- Up to 4 Hz position update rate
- GALILEO-ready (LEA-5H)

Features

<table>
<thead>
<tr>
<th>Series</th>
<th>Power</th>
<th>Size</th>
<th>Memory</th>
<th>Function</th>
<th>Antenna</th>
<th>Input / Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage-range (V)</td>
<td>Thickness (mm)</td>
<td>Programmable (Flash)</td>
<td>Power save mode</td>
<td>KickStart</td>
<td>Dead Reckoning</td>
<td>Raw data</td>
</tr>
<tr>
<td>LEA-SH</td>
<td>2.7 - 3.6</td>
<td>3</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>LEA-SS</td>
<td>2.7 - 3.6</td>
<td>3</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
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<tr>
<td>LEA-SA</td>
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<td>*</td>
<td>*</td>
<td>*</td>
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<td>2.4</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

Ordering information

LEA-SH-0  Progr. u-blox 5 GPS module with KickStart
LEA-SS-0  ROM-based u-blox 5 GPS module with KickStart
LEA-SA-0  u-blox 5 ROM-based GPS module
LEA-SQ-0  ROM-based u-blox 5 GPS module with KickStart
LEA-SM-0  ROM-based u-blox 5 GPS module

Available as samples and tape on reel (250 pieces)

Mechanical data

Dimensions 22.4 x 17 x 3 mm
Weight 2.1 g

Electrical data

Power supply 2.7 to 3.6 V
Power consumption¹ 72 mW @ 3.0 V Power save mode
132 mW @ 3.0 V Eco mode
141 mW @ 3.0 V Max performance mode
Backup power 1.4 V to 3.6 V, 25 µA
Antenna type Active and passive
Antenna power Internal or external VCC_RF
Antenna supervision Integrated short-circuit detection and antenna shutdown, open circuit detection is supported with AADDET_N input and little external circuitry

Support products

EVK-SH: u-blox5 Evaluation Kit with KickStart suitable for LEA-SH, LEA-SS, LEA-SQ
EVK-SP: u-blox5 Evaluation Kit with SuperSense® suitable for LEA-SA, LEA-SM

Receivers

LEA-5H: u-blox 5 Progr. with SuperSense® suitable for LEA-SA, LEA-5S
LEA-5A: u-blox 5 ROM-based GPS module
LEA-5M-0 ROM-based u-blox 5 GPS module

Supported standards

- GPS L1 C/A code
- GALILEO L1 open service (w/ upgrade)
- SBAS: WAAS, EGNOS, MSAS, GAGAN

Max. update rate 4 Hz (ROM version)
2 Hz (Flash version)

Accuracy¹ Position 2.5 m CEP
SBAS 2.0 m CEP

Acquisition¹ LEA-SH/SS/5Q LEA-SA/SM
29 s 32 s
Cold starts
Warm starts 29 s 32 s
Aided starts ≤ 1 s ≤ 1 s
Hot starts ≤ 1 s ≤ 3 s

Sensitivity² LEA-SH/SS/5Q LEA-SA/SM
Cold starts –160 dBm –160 dBm
Reacquisition –160 dBm –160 dBm
Tracking –144 dBm –143 dBm

Timing Accuracy RMS 30 ns
99% < 60 ns
Granularity 21 ns

Time Pulse Configurable 0.25 to 1000 Hz

A-GPS Supports AssistNow Online and AssistNow Offline
OMA SUPL compliant

Operational limits

Velocity: 500 m/s (972 knots)
Altitude: 50,000 m

Operating temp. –40°C to 85°C
Storage temp. –40°C to 85°C

¹ All SV @ –130 dBm
² Dependent on aiding data connection speed and latency
³ Demonstrated with a good active antenna
LEA-5T
u-blox 5 GPS receiver with Precision Timing

Product description
The LEA-5T supports precision GPS timing for demanding positioning applications such as femto cells and WiMAX basestations. It features a time mode function whereby the GPS receiver assumes a stationary 3D position, whether programmed manually or determined by an initial self-survey. Stationary operation enables GPS timing with only one visible satellite and eliminates timing errors which otherwise result in positioning errors. An accuracy of up to 15 ns is achievable by using the quantization error information to compensate the granularity of the time pulse. A built-in time mark and counter unit provide precise time measurement of external event inputs.

Highlights
- 50-channel u-blox 5 engine with over 1 million effective correlators
- < 1 second Time-To-First-Fix for hot and aided starts
- SuperSense® indoor GPS with best-in-class acquisition and tracking sensitivity
- Supports AssistNow Online A-GPS service; OMA SUPL compliant
- Hybrid GPS and SBAS (WAAS, EGNOS, MSAS, GAGAN) engine
- Stationary mode for GPS timing operation
- Output timepulse with at least one satellite in view

Features

<table>
<thead>
<tr>
<th>Series</th>
<th>Power</th>
<th>Size</th>
<th>Memory</th>
<th>Function</th>
<th>Antenna</th>
<th>Input / Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEA-5T</td>
<td>2.7 - 3.6 V</td>
<td>2.1 g</td>
<td>Programmable</td>
<td>Power save mode</td>
<td>Power save mode</td>
<td>Power save mode</td>
</tr>
</tbody>
</table>

Electrical data
- Power supply: 2.7 to 3.6 V
- Power consumption: 132 mW @ 3.0 V Eco mode, 141 mW @ 3.0 V Max. performance mode
- Backup power: 1.4 V to 3.6 V, 25 µA
- Antenna type: Active and passive
- Antenna power: External or internal VCC_RF
- Antenna supervision: Integrated short-circuit detection and antenna shutdown, open circuit detection is supported with AADET_N input and little external circuitry

Timer performance data
- Timing accuracy RMS: 30 ns, 99% < 60 ns
- Granularity: 21 ns, Compensated: 15 ns
- Time pulse: Configurable 0.25 to 1000 Hz
- Time mark / counter: Configurable, 1

Support products
- EVK-5T: u-blox 5 Evaluation Kit with Precision Timing

Interfaces
- Serial: 1 UART interfaces
- Digital I/O: Configurable time pulse, 1 EXTINT input, 1 Reset

Receiver performance data
- Receiver type: 50-channel u-blox 5 engine GPS L1 C/A code
- SBAS: WAAS, EGNOS, MSAS, GAGAN
- Accuracy: Position 2.5 m C, 95% P, SBAS 2.0 m C, 95% P
- Acquisition: Cold starts: 29 s, Warm starts: 29 s, Aided starts: < 1 s, Hot starts: < 1 s
- Sensitivity: Cold starts: –144 dBm, Reacquisition: –160 dBm, Tracking: –160 dBm
- Multipath suppression: Intelligent multipath detection and suppression
- A-GPS: Supports AssistNow Online and AssistNow Offline, OMA SUPL compliant
- Operational limits: Velocity: 500 m/s (972 knots), Altitude: 50,000 m
- Operating temp.: –40°C to 85°C, Storage temp.: –40°C to 85°C

Ordering information
- LEA-5T-0: u-blox 5 Precision Timing GPS module
  - Available as samples and tape on reel (250 pieces)
ANTARIS®4 GPS receiver with Dead Reckoning

Product description

The LEA-4R and TIM-4R are Dead Reckoning GPS modules powered by the 16-channel ANTARIS®4 engine. Dead Reckoning works by combining GPS satellite position data, gyroscope data (measuring angle turns) and odometer data (measuring distance covered) to calculate a position. This enables accurate navigation even in locations with poor or absent GPS signals such as tunnels, indoor parking facilities and deep urban canyons. This makes these modules ideal for applications requiring 100% road coverage.

Highlights

- 100% coverage: Continuous position fixes even in tunnels
- Highly accurate and reliable navigation performance
- Automatic sensor calibration and temperature compensation
- Supports AssistNow Online A-GPS service
- 40 Hz Dead Reckoning calculation rate

We recommend the use of u-blox 5 based modules for new designs.

<table>
<thead>
<tr>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series</td>
</tr>
<tr>
<td>LEA-4R</td>
</tr>
<tr>
<td>TIM-4R</td>
</tr>
</tbody>
</table>
Mechanical data

- **Dimensions**: 22.4 x 17 x 3 mm
- **Weight**: 2.1 g

Interfaces

- **Serial interfaces**
  - LEA-4R: 1 USB V1.1 (2.0 compatible)
  - 1 UART
  - 1 SPI
- **TIM-4R**: 2 UARTs
- **Digital input ports**: SPEED, Wheel pulse input
- **Digital output ports**: TIM-PULSE, Configurable time
- **Serial, SPI and I/O Voltages**: LEA-4R: Configurable output levels between 1.65V and 3.6V, 5V tolerant inputs
- **TIM-4R**: 3V levels, 5V tolerant inputs
- **Protocols**: NMEA, UBX binary, RTCM

Electrical data

- **Power supply**: 2.7 to 3.3 V
- **Power consumption**: typ 48 mA @ 3.0 V
- **Backup power**: 1.5 to 3.6 V, typ. 5 mA
- **Antenna**: External or Internal VCC_RF
- **Antenna supervision**: Integrated short-circuit detection and antenna shutdown, open circuit detection is supported with AADet_N input and little external circuitry

Receiver performance data

- **Receiver type**: 16 channel, L1 frequency, C/A code
- **Max. update rate**: 1 Hz
- **Accuracy**
  - Position: 2.5 m CEP
  - DGPS: 2.0 m CEP
- **Start-up times**
  - Hot start: < 3.5 s
  - Warm start: 33 s
  - Cold start: 34 s
  - Reacquisition: < 1 s
- **Sensitivity**
  - Acquisition: -140 dBm
  - Tracking: -150 dBm
- **Timing RMS**: 50 ns
- **Granularity**: 100 ns
- **Operational limits**: Velocity: 500 m/s (972 knots)
  - Altitude: 50,000 m

Dead Reckoning

- **Calculation rate**: 40 Hz
- **Wheel tick input range**: 1 to 5000 Hz

Support products

- **AEK-4R**: An easy-to-use kit to get familiarized with the ANTARIS®4 positioning technology and to evaluate functionality and visualize GPS and Dead Reckoning performance. Gyroscope is included.

Ordering information

- **LEA-4R-0-000-0**: Dead Reckoning GPS module
- **TIM-4R-0-000-0**: Dead Reckoning GPS module

- **LEA-4R**: Delivery packing: 0 = Single samples
- **TIM-4R**: Delivery packing: 0 = Single samples

PCI-5S u-blox5 GPS PCI card

**Product description**

The PCI-5S enables simple integration of GPS functionality into MRDs, UMPCs, laptops and similar applications. The PCI-5S is a ready-to-use solution, composed of a GPS chipset incorporated into the PCI Express MiniCard platform. It features the high performance u-blox5 positioning engine and includes a USB 2.0 interface.

**Highlights**

- 50-channel u-blox 5 engine with over 1 million effective correlators
- < 1 second TTIFF for hot and aided starts
- ~160 dBm SuperSense® indoor GPS acquisition and tracking sensitivity
- Accelerated startup at weak signals with KickStart feature

**Receiver performance data**

- **Receiver type**: 50-channel u-blox 5 engine
- **GPS L1, C/A code**: GSAS, WAAS, EGNOS, MSAS, GAGAN
- **Max. update rate**: 4 Hz
- **Accuracy**
  - Position: 2.5 m CEP
  - DGPS: 2.0 m CEP
- **Acquisition**
  - Cold start: 29 s
  - Warm start: 29 s
  - Aided starts: < 1 s
  - Hot starts: < 1 s
- **Sensitivity**
  - Acquisition: ~160 dBm
  - Tracking: ~160 dBm
- **Timing RMS**: 100 ns
- **Granularity**: 400 ns

**Support products**

- **EVK-5H**: u-blox 5 GPS Evaluation Kit
  - An easy-to-use kit to get familiar with the u-blox 5 positioning technology, and to evaluate functionality and to visualize GPS performance.

**Interfaces**

- **Antenna Conn.**: Hirose U.FL-R-SMT
- **USB**: V2.0 Full Speed 12 Mbit/s (Through PCI connector)
- **Digital I/O**: LED_GPS_STATE Radio state indicator

**Power supply**: 3.3 V supply rail: 2.7 to 3.6 V

**Power consumption**: 123 mW @ 3.0V Eco Mode

**Backup power**: 1.5 V to 3.6V, typ. 5 µA

**Antenna**: Active and passive

**Environmental data**

- **Operating temp.**: –40°C to 85°C
- **Storage temp.**: –40°C to 85°C

**Dimensions**

- **50.95 x 30 x 3.0 mm**
PCM-5S
u-blox 5 GPS PCI card

Product description
The PCM-5S enables simple integration of GPS functionality into MIDs, UMPCs, laptops and similar applications. The PCM-5S is a ready-to-use solution, composed of a GPS chipset incorporated into the PCI Express Half Mini-Card platform. It features the high performance u-blox 5 positioning engine and includes a USB 2.0 interface.

Highlights
- 50-channel u-blox 5 engine with over 1 million effective correlators
- < 1 second TTFF for hot and aided starts
- –160 dBm SuperSense® indoor GPS acquisition and tracking sensitivity
- Accelerated startup at weak signals with KickStart feature

Receiver performance data

<table>
<thead>
<tr>
<th>Receiver type</th>
<th>50-channel u-blox 5 engine</th>
<th>GPS L1 C/A code</th>
<th>SBAS: WAAS, EGNOS, MSAS, GAGAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. update rate</td>
<td>4 Hz</td>
<td>Position</td>
<td>2.5 m CEP</td>
</tr>
<tr>
<td>Accuracy1</td>
<td>Cold start</td>
<td>29 s</td>
<td></td>
</tr>
<tr>
<td>Acquisition1</td>
<td>Warm start</td>
<td>29 s</td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>Aided starts2</td>
<td>&lt; 1 s</td>
<td></td>
</tr>
<tr>
<td>Multipath Suppression</td>
<td>Hot starts</td>
<td>&lt; 1 s</td>
<td></td>
</tr>
<tr>
<td>A-GPS</td>
<td>Gain coverage</td>
<td>&gt; -4 dBc at -90° ≤ θ ≤ +90° (over 7 x 7 cm ground plane)</td>
<td></td>
</tr>
<tr>
<td>Gain without cable</td>
<td>1 Watt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power handling</td>
<td>123 mW @ 3.0 V Eco Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>1.5 V to 3.6 V, typ. 5 μA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backup power</td>
<td>Active and passive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antenna</td>
<td>Active and passive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental data</td>
<td>Operating Temp.</td>
<td>–40°C to 85°C</td>
<td></td>
</tr>
<tr>
<td>Storage Temp.</td>
<td>–40°C to 85°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gain coverage</td>
<td>&gt; -4 dBc (over 7 x 7 cm ground plane)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power handling</td>
<td>1 Watt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polarization</td>
<td>RHCP (Right-handed circular polarization)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VSWR</td>
<td>&lt; 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bandwidth</td>
<td>Min. 10 MHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impedance</td>
<td>50 Ω</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise figure</td>
<td>Max. 1.8 dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output VSWR</td>
<td>Max. 2.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC voltage</td>
<td>2.7 V – 6 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC current</td>
<td>typ. 8.5 mA, ± 4.5 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical data</td>
<td>Weight</td>
<td>42 g (without cable)</td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>48 x 40 x 13 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable</td>
<td>5 m RG174 standard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connectors (choice)</td>
<td>SMA, SMB, MCX, FAKRA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting</td>
<td>Magnetic base</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Housing color</td>
<td>Black</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ordering information

PCM-5S-1 ROM-based u-blox 5 PCI Express Half MiniCard

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ANN-M5
High performance active GPS antenna

Product description
The high performance ANN-M5 active GPS antenna with integrated low-noise amplifier (LNA) is the perfect match to the u-blox GPS receivers where high sensitivity and optimum sky coverage are essential.

Patch antenna characteristics

| Frequency | 1575 ± 3 MHz |
| VSWR | Max. 2 |
| Bandwidth | Min. 10 MHz |
| Impedance | 50 Ω |
| Peak gain | Max. 4 dB |
| Noise figure | Max. 1.8 dB |
| Output VSWR | Max. 2.0 |
| DC voltage | 2.7 V – 6 V |
| DC current | typ. 8.5 mA, ± 4.5 mA |
| Mechanical data | Weight | 42 g (without cable) |
| Size | 48 x 40 x 13 mm |
| Cable | 5 m RG174 standard |
| Connectors (choice) | SMA, SMB, MCX, FAKRA |
| Mounting | Magnetic base |
| Housing color | Black |

Ordering information

ANN-M5-0-005-0 Active GPS antenna

Options
- 0 = SMA connector
- 1 = SMB connector
- 2 = MCX connector
- 3 = FAKRA connector

---

Environmental data

- Operating temperature: –40°C to 85°C
- Storage temperature: –50°C to 85°C
- Humidity: 95% ~ 100% RH
- Vibration: Sine sweep 1G (0-peak), 10 – 150 – 10 Hz each axis

CE approval

Applicable standards
- ETSI EN 301 489-19 V1.2.1:2002
- Electromagnetic compatibility and radio spectrum matters (ERM)
- Part 19: Specific conditions for receive-only mobile earth stations (ROMES) operating in the 1,5 GHz band providing data communication.
Overview

Based on a proprietary high-performance architecture with 50 parallel channels and 1 million effective correlators, u-blox’ powerful range of GPS receiver chips and chipsets is ideal for consumer as well as automotive applications.

Key benefits include

- Ultra-fast acquisition time: Time To First Fix (TTFF) of less than 1 second for hot and aided starts
- World’s highest GPS sensitivity down to –160 dBm based on u-blox’ industry-leading SuperSense® technology
- Very small outline packages ideal for small end products with tight space and low cost requirements
- GPS and GAIILEO compatible
- Low cost solution requires only 19 passive external components and works with standard crystals
- Flexible, low operating voltage options as low as 1.3 V
- Noise suppression architecture allows embedding in computers, mobile phones, PDAs, industrial and automotive electronics
- Consumer and Automotive grade qualified

Product selector: u-blox5 GPS chips and chipsets

<table>
<thead>
<tr>
<th>Series</th>
<th>Grade</th>
<th>Size</th>
<th>Package</th>
<th>Technology</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>UBX-G5010-ST</td>
<td>Standard</td>
<td>8 x 8 x 0.85</td>
<td>MLF-56</td>
<td>**</td>
<td>1 1 P 1</td>
</tr>
<tr>
<td>UBX-G5010-SA</td>
<td>Automotive</td>
<td>8 x 8 x 0.85</td>
<td>MLF-56</td>
<td>**</td>
<td>1 1 P 1</td>
</tr>
<tr>
<td>UBX-G5000-ET</td>
<td>Standard</td>
<td>9 x 9 x 0.91</td>
<td>MLF-24</td>
<td>CVBGA-100</td>
<td>2 1 P 1</td>
</tr>
<tr>
<td>UBX-G0010-QT</td>
<td>Automotive</td>
<td>4 x 4 x 0.85</td>
<td></td>
<td>CVBGA-100</td>
<td>2 1 P 1</td>
</tr>
</tbody>
</table>

OE = Optional
F = Firmware upgrade required once GALILEO system is fully operational
O = Optional
P = Planned

Based on a proprietary high-performance architecture with 50 parallel channels and 1 million effective correlators, u-blox’ powerful range of GPS receiver chips and chipsets is ideal for consumer as well as automotive applications.
UBX-G5010, G5000/G0010
u-blox 5 single chips and chipsets

Product description
The UBX-G5010 and UBX-G5000/UBX-G0010 are the single chip and chipsets versions of the high performance u-blox 5 positioning engine. Featuring the fastest acquisition on the market, these chips were also developed with cost-effectiveness in mind. The minimal BOM requires as few as 19 passive components, the chips include an integrated LDO and LNA, there is no need for an external Flash memory and TCXO, and their small footprint allows for cost-effective use of board area.

Highlights
- 50-channel u-blox 5 engine with over 1 million effective correlators
- < 1 second Time-To-First-Fix for Hot and Aided Starts
- –160 dBm SuperSense® tracking sensitivity
- Accelerated startup at weak signals with KickStart feature
- Supports AssistNow Online and AssistNow Offline A-GPS services; OMA SUPL compliant
- The advanced jamming suppression mechanism and innovative RF architecture ensures maximum GPS and GALILEO performance even in hostile environments such as urban canyons and other areas with weak signal coverage. The UBX-G5010 is the ideal solution for cost sensitive applications that don’t require firmware updates, while the UBX-G5000 and UBX-G0010 allow flash memory for firmware updates.

Features
- Supports AssistNow Online and AssistNow Offline A-GPS services; OMA SUPL compliant
- High immunity to jamming
- Hybrid GPS, GALILEO and SBAS (WAAS, EGNOS, MSAS, GAGAN) engine
- 4 Hz position update rate
- RoHS compliant (lead-free) and green (no halogens)

Receiver performance data
<table>
<thead>
<tr>
<th>Receiver type</th>
<th>50-channel u-blox 5 engine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. update rate</td>
<td>4 Hz (ROM version) 2 Hz (Flash version)</td>
</tr>
<tr>
<td>Accuracy1</td>
<td>Position 2.5 m CEP SBAS 2.0 m CEP</td>
</tr>
<tr>
<td>Acquisition1</td>
<td>TCXO Crystal</td>
</tr>
<tr>
<td>Cold starts</td>
<td>29 s 32 s</td>
</tr>
<tr>
<td>Warm starts</td>
<td>29 s 32 s</td>
</tr>
<tr>
<td>Aided starts2</td>
<td>&lt; 1 s &lt; 1 s</td>
</tr>
<tr>
<td>Hot starts</td>
<td>&lt; 1 s &lt; 1 s</td>
</tr>
<tr>
<td>Sensitivity2</td>
<td>TCXO Crystal</td>
</tr>
<tr>
<td>Acquisition</td>
<td>–160 dBm –160 dBm</td>
</tr>
<tr>
<td>Tracking</td>
<td>–160 dBm –160 dBm</td>
</tr>
<tr>
<td>Cold starts</td>
<td>–144 dBm –143 dBm</td>
</tr>
<tr>
<td>A-GPS</td>
<td>Supports AssistNow Online and AssistNow Offline, OMA SUPL compliant</td>
</tr>
<tr>
<td>Operational limits</td>
<td>Velocity: 500 m/s (972 knots) Altitude: 50,000 m</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interfaces</th>
<th>Data width: 16 bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>External memory interfaces (CVBGA only)</td>
<td>Address space: 3 x 4 M Bytes</td>
</tr>
<tr>
<td>Serial interfaces</td>
<td>1 UART (UBX-G5010) 2 UARTS (UBX-G5000) 1 USB V2.0 full speed 12 Mbit/s 1 DDC (1°C compliant) 1 SPI (planned)</td>
</tr>
<tr>
<td>Digital I/O</td>
<td>Configurable time pulse 2 EXTINT interrupt inputs 10 configuration pins (UBX-G5010) 12 configuration pins (UBX-G5000)</td>
</tr>
</tbody>
</table>

Electrical data
| Supply/Voltage | Single voltage supply: 1.4 V or 2.5 – 3.6 V Dual voltage supply: 1.3 V / 1.8 V |
| Voltage Level | 1.65 – 3.6 V |
| Power Consumption | 64 mW (tracking & navigating) |
| Backup Supply | Voltage range: 1.4 to 3.6 V |
| Antenna Supervision | Short and open circuit detection supported with external circuit |
| Antenna Type | Active and passive |

Ordering information
<table>
<thead>
<tr>
<th>Standard type</th>
<th>u-blox 5 single chip GPS receiver, 56 Pin MLF(QFN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UBX-G5010-ST</td>
<td>u-blox 5 baseband processor, 100 pin CVBGA</td>
</tr>
<tr>
<td>UBX-G5000-BT</td>
<td>u-blox 5 RF front-end IC, 24 pin MLF(QFN)</td>
</tr>
<tr>
<td>UBX-G0010-QT</td>
<td>u-blox 5 single chip GPS receiver, 56 Pin MLF(QFN)</td>
</tr>
<tr>
<td>UBX-G5000-B8</td>
<td>u-blox 5 baseband processor, 100 pin CVBGA</td>
</tr>
<tr>
<td>UBX-G0010-QA</td>
<td>u-blox 5 RF front-end IC, 24 pin MLF(QFN)</td>
</tr>
</tbody>
</table>

Environmental data
| Operating temp. | –40°C to 85°C |

Packages
<table>
<thead>
<tr>
<th>Single package</th>
<th>UBX-G5010: 56 Pin MLF(QFN) 8.8 x 8 x 0.35 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chipset</td>
<td>UBX-G5010: 24 Pin MLF(QFN) 4.4 x 4.2 x 0.85 mm UBX-G5000: 100 Pin CVBGA 9.9 x 9 x 0.91 mm</td>
</tr>
</tbody>
</table>
GPS solutions

Overview

Capture & Process solution for instant geotagging

Geotagging is a powerful and increasingly popular means of looking at, sorting, finding, and sharing all sorts of things, from photographs and videos to points and events of interest. In the age of user generated content, it is a powerful way to manage media based on where it was created.

Through the acquisition of Geotate, u-blox now licenses powerful geotagging software and services supporting portable consumer devices, especially cameras, where fast GPS signal capture and lowest power consumption are critical for a seamless user experience.

AssistNow solution for accelerated GPS

GPS users expect instant position information. Under adverse signal conditions, however, data downloads from satellites to the GPS receiver and subsequent positional fix can take an unacceptably long time.

u-blox’ AssistedNow assisted GPS (A-GPS) service boosts acquisition performance by providing satellite positional data to the GPS receiver via wireless networks or the Internet. This enables the GPS receiver to compute a position within seconds, even under poor signal conditions.

AssistNow requires no additional hardware and generates virtually no CPU load. The system is very easy to integrate: Customers can install it and be operational within a day.

Key benefits include

- Instant location capture: GPS signal data is captured on-demand in 1/5th of a second – no waiting for satellite acquisition. Just point and shoot
- Extremely low power geotagging solution has negligible impact on camera battery life
- Fast time-to-market: complete end-to-end, market-proven software and hardware architecture
- Cost-effective solution: requires only a standard GPS RF front-end and your PC or Mac does the rest

Available products based on our breakthrough "Capture & Process" technology:

YUMA
Embedded geotagging solution for cameras. YUMA makes geotagging photographs and videos as simple as pressing a button.

KATO
Geotagging solution for camera accessories via a standard hot-shoe. KATO provides geotagging capabilities to existing cameras.

*Please refer to our Technology section in this catalog for a detailed description of GPS Capture & Process.
**YUMA**

Geotagging software and service for digital cameras

**Product description**

YUMA is the core desktop software positioning engine and historic assistance service that enables digital cameras to geotag in an instant. Simply capture 200 ms of raw GPS data on your camera and then pass this to our YUMA software to convert it into a position fix.

**Highlights**

- Enables instant and low power geotagging in cameras
- The YUMA software is supported by a highly reliable u-blox historic ephemeris assistance service accessible worldwide
- Optimised multi-core software that can calculate a fix in under 1 s
- YUMA has a SDK and simple API for easy integration with a customer’s application
- Optionally, a reverse geocoding service is available for converting a location into an address together with relevant Points Of Interest (POI's)

**Software and service performance data**

The following performance data is based on 172 ms of 1-bit GPS data captured from a Maxim 2769 running at a rate of 6 MHz.

- **Accuracy**
  - Position: 10 m
- **Processing efficiency**
  - Time to calculate a fix: 0.4 s
- **Sensitivity**
  - No position estimate: -144 dBm
  - With estimate: -147 dBm
- **Server Reliability**
  - Ephemeris data: 99.9%

1. CEP, 50%, -130 dBm
2. Running on a 1.866 GHz Core 2 Duo with Windows XP 32 bit
3. Estimate within 100 km and 5 minutes

**Support platforms**

YUMA software and SDK are available for Microsoft Windows XP 32bit (SP2) and Vista 32/64 bit (SP1) and Mac OS-X (Intel). Windows 7 under preparation.

**Support products**

u-blox provides complete support tools for the evaluation, manufacturing and software integration of the YUMA solution for camera geotagging into OEM products.

A market-proven reference design is available, please visit the “Capture & Process” section of our website at www.u-blox.com for further details.

**KATO**

Geotagging software and service for camera accessories

**Product description**

The KATO reference design provides all elements needed to build a camera hot-shoe accessory for photo geotagging. Using u-blox’ Capture & Process technology, KATO-based products capture location data the instant a photo is taken. When photos are uploaded to a PC, KATO software processes the data captures to obtain position fixes with the help of u-blox’ online Historic Ephemeris Assistance service. The software matches fixes to photos and geotags them with location information (i.e., address and POI data) via the u-blox Reverse Geocoding service. A Software Developing Kit is also available to allow customers to develop their own photo geotagging applications.

**Highlights**

- Market-proven hardware/software reference design for fast time to product
- Hardware is compact, lightweight and connects via standard camera hot-shoe
- Instantaneous, automatic location capture
- Months of use on a single battery charge
- Photo geotagging application software for Windows XP/Vista & (Intel) Mac OS-X
- Highly reliable u-blox internet services provide worldwide Historic Assistance data and Reverse Geocoding
- Software tools to support manufacturing testing of KATO-based products

**Mechanical data**

- **Dimensions**: 56.1 x 40.5 x 10 mm
- **Weight**: 25 g
- **Interface**: USB mini-A
- **Capture Size**: 128 kBytes
- **Storage Capacity**: 2000 captures
- **Power Supply Type**: Rechargeable LiPo
- **Power Supply Capacity**: 130 mAh
- **Energy per capture**: 18 mJ

1. Dependent on selected NAND flash size. 1000 captures per gigabit

**Performance data**

- **Accuracy**: 10 m
- Average time to calculate fix: 0.4 s
- Sensitivity (no estimate): -144 dBm
- Sensitivity (with estimate): -147 dBm
- **Server availability**: 99.9%

1. CEP, 50%, -130 dBm
2. Running on a 1.866 GHz Core 2 Duo with Windows XP 32 bit
3. Estimate within 100 km and 5 minutes

**Support products**

u-blox provides complete support tools for the evaluation, manufacturing and software integration of the KATO solution for camera accessory geotagging into OEM products.

A market-proven reference design is available, please visit the “Capture & Process” section of our website at www.u-blox.com for further details.
AssistNow – free A-GPS services

The challenge of stand-alone GPS
GPS users expect instant position information. With standard GPS this is not always possible because at least four satellites must transmit their precise orbital position data, called Ephemeris, to the GPS receiver. Under adverse signal conditions, data downloads from the satellites to the receiver can take minutes, hours, or even fail altogether.

Assisted GPS (A-GPS) boosts acquisition performance by providing data such as Ephemeris, Almanac, accurate time and satellite status to the GPS receiver via mobile networks or the Internet. The provision of aiding data enables the receiver to compute a position within seconds, even under poor signal conditions.

AssistNow A-GPS
AssistNow is the free, end-to-end A-GPS service for u-blox OEM customers and their end users. This service boosts acquisition performance for a wide spectrum of end products with or without connectivity. AssistNow is available in Online and Offline versions, which can either be used alone or in combination. AssistNow requires no additional hardware and generates virtually no CPU load. The system is very easy to integrate: Customers can install it and be operational within a day.

With AssistNow Online, a GPS device with mobile network connectivity accesses and downloads assistance data from our Global Reference Network of GPS receivers at system start-up. Employing user plane communication and open standards such as TCP/IP, AssistNow Online works on all standard mobile communication networks that support Internet access, including GPRS, UMTS and Wireless LAN. No special arrangements with mobile network operators are needed to enable AssistNow Online, making this solution network operator independent and globally available. u-blox only sends ephemeris data for those satellites currently visible to the mobile device requesting the data, thus minimizing the amount of data transferred.

With AssistNow Offline, users download almanac plus Differential Almanac Correction Data from the Internet at their own convenience. The service requires no connectivity at system start-up, thus enabling users to enjoy instant positioning, even when no mobile network is available.

Users can download almanac plus files anytime they have an internet connection, for example at home, in the office or through a wireless network such as GPRS, UMTS or a wireless LAN. The correction data is then downloaded to the mobile terminal via TCP/IP, serial port, memory card, etc. and can either be stored in the GPS receiver’s flash EPROM (if available) or in the memory of the application processor.

u-blox provides almanac plus data files with corrections valid from 1 to 14 days. The size of these files increases with the length of the prediction period, from as little as 3 KB to 90 KB. Positioning accuracy decreases with the length of the correction file duration, with 1–3 day files providing relatively high accuracy and 10–14 day files progressively less accuracy. Regular updates help to ensure a high level of position accuracy.

Services: AssistNow framework

The AssistNow framework consists of the following elements:

- **AssistNow Global Reference Network** is a worldwide network of GPS receivers, which gather satellite information such as Ephemeris, Almanac, satellite health and status, and forwards this information to the AssistNow root server.

- **AssistNow Root Server** collects the data from the Global Reference Network, calculates the assistance data and handles data requests originating from mobile terminals or other devices. On request, the root server generates the data packets and transmits them either directly to the customer’s terminal, mobile device or proxy server.

An optional **Proxy Server** set-up (implemented by the customer) enables individual requests from mobile terminals to be locally handled by the customer’s proxy server. This server receives regular aiding data information updates from the u-blox AssistNow root server, ensuring that up-to-date information is available to user terminals when requested. This solution is totally scalable and gives the customer full control and data privacy. Customers can use their communication link of choice for the communication between the user terminals and the server.

In the **Mobile Terminal** microcontroller resides a very simple piece of software. This provides communication with the root or proxy server over a network and transfers data to the GPS receiver via UART, USB, SPI or PC interfaces.

### Benefits of AssistNow
- Free for u-blox customers and their end users
- Fast Time-To-First-Fix, even under poor signal conditions
- Global coverage
- Network operator independent
- Available with all u-blox5 and selected ANTARIS®4 products
- Easy to install

<table>
<thead>
<tr>
<th>AssistNow Online</th>
<th>AssistNow Offline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data download frequency</td>
<td>At every startup</td>
</tr>
<tr>
<td>Data retrieval at start-up</td>
<td>Data downloaded from server</td>
</tr>
<tr>
<td>Downloaded aiding data types</td>
<td>Ephemeris, Almanac</td>
</tr>
<tr>
<td>Data validity period</td>
<td>2 - 4 hours</td>
</tr>
<tr>
<td>Size of downloaded data</td>
<td>1 - 3 KB</td>
</tr>
<tr>
<td>Acquisition (TTFF) performance</td>
<td>As low as 1 second</td>
</tr>
</tbody>
</table>
u-blox now offers wireless transceiver modules based on the GSM/GPRS mobile communications standard. LEON provides embedded quad-band GSM/GPRS class 10 functionality in a small-outline, surface mount module. LEON communicates with u-blox’ standard GPS modules via a 2-wire I2C interface allowing for simple control and interfacing to both modules via a single UART.

LEON is optimized for low-cost, mass market GPS/wireless applications requiring mobile connectivity such as asset tracking, fleet management, vehicle recovery and mobile emergency services. It is also ideal as a stand-alone wireless communications module for machine-to-machine applications such as Automatic Meter Reading (AMR), Remote Monitoring Automation and Control (RMAC), surveillance and security, and Point of Sales (PoS) terminals.

Key benefits include

- Off-the-shelf GSM and GPRS connectivity: including embedded TCP/IP stack, multiple socket & multiple IP addresses
- Small footprint for compact designs: ideal for applications with strict space constraints
- Simple low-cost mounting: Surface-mount pads are on only two sides of the package resulting in simple and low-cost PCB mounting
- Low idle mode current for long battery life: < 1.6 mA
- Easy integration with u-blox’ GPS modules and Assisted GPS solution for location-based applications with mobile connectivity
- Audio interface for voice services supports emergency telematics services such as eCall
- Extended temperature range for industrial and automotive applications: –30°C to +85°C
- Fast time-to-market: reference designs and evaluation tools minimize design-in time
LEON-G100/G200
Quad Band GSM/GPRS data and voice module

Product description
The LEON-G100/G200 modules from u-blox are cost efficient solutions bringing full feature Quad Band GSM/GPRS data and voice transmission technology in a compact form factor. Featuring low power consumption and GSM/GPRS class 10 data transmission with voice capability, the LEON-G100/G200 combine baseband, RF transceiver, power management unit, and power amplifier in a single, easy-to-integrate solution.

The LEON-G100/G200 are complete, fully qualified and certified solutions enabling reduced costs and short time to market. These modules are ideally suited for M2M and automotive applications such as: Automatic Meter Reading AMR, Remote Monitoring Automation and Control RMAC, surveillance and security, e-call, road pricing, asset tracking, fleet management, anti theft systems and Point of Sales PoS terminals.

Highlights
- Full feature quad-band GSM/GPRS, class 10
- Embedded TCP/IP and UDP/IP stack
- Lowest standby current: < 1.6 mA
- Simple integration of u-blox GPS and A-GPS
- Extended operating temperature range: -30°C to +85°C
- SMT mountable for automatic assembly

Features

<table>
<thead>
<tr>
<th>Features</th>
<th>Interface</th>
<th>Voice</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Série</td>
<td>UART</td>
<td>Digital Audio</td>
<td>Antenna Supervisor, Jamming Detection, TCM, &amp; DMPF, PDP</td>
</tr>
<tr>
<td></td>
<td>ADC</td>
<td>Analog Audio</td>
<td>Battery Charging, Antenna Supervisor, Jamming Detection, TCM, &amp; DMPF, PDP, GS as GSM Modem</td>
</tr>
<tr>
<td>LEON-G100</td>
<td></td>
<td></td>
<td>EmbeddedAssiflow Client, External UART, Internal UART</td>
</tr>
<tr>
<td>LEON-G200</td>
<td></td>
<td></td>
<td>EmbeddedAssiflow Client, External UART, Internal UART</td>
</tr>
</tbody>
</table>

The LEON-G100/G200 support full access to u-blox GPS via the GSM modem. Thus GSM and GPS can be controlled through a single serial port from any host processor. The LEON-G100/G200’s compact form factor and SMT pads enable fully automatic assembly processes with standard pick-and-place equipment and reflow soldering, permitting cost-efficient, high-volume production.

Software features
- TCP/IP and UDP/IP
- Internet (FTP, HTTP, SMTP)
- Firewall
- Multiple socket & multiple IP addresses
- Jamming indication (GSM)
- Firmware update through UART
- Firmware update over-the-air
- Access to u-blox GPS via GSM modem
- AssistNow client for fastest GPS Time-to-First-Fix

Ordering information
- LEON-G100-00S LEON-G100 – Quad Band GSM/GPRS module
- LEON-G200-00S LEON-G200 – Quad Band GSM/GPRS module with extended feature set
- Delivery Packing Tape on reel (250 pieces)

Software features
- VK-G25P An easy-to-use kit to get familiar with the GSM/GPRS performance of the LEON-G100/G200

Mechanical data
Dimensions 29.5 x 18.9 x 2.84 mm
Weight < 5 g
Operating temp. -30°C to 85°C
Wireless solutions

u-blox licenses complete, tested, off-the-shelf reference designs for embedded wireless GSM modems ready to be integrated into OEM end-products and mass produced. The designs provide all necessary hardware specifications, software binaries including protocol stack, certification test reports and production tools design.

The result is a wireless, ultra-compact, low power voice and data communications solution which is quickly and easily integrated into consumer, industrial and automotive OEM designs, ready for mass-production. u-blox also supports customers in product certification, training, production ramp-up and maintenance.

u-blox licenses market-proven reference designs for the following communication standards:

**N709Q: GSM/GPRS modem reference design**
- **Description**: The N709Q modem design combines baseband processor, RF transceiver, and power management components to support quad-band GSM/GPRS functionality including voice, data and SMS capabilities.
- **Typical applications**: Point of Sales terminals (PoS), Automatic Meter Reading (AMR), Remote Monitoring Automation and Control (RMAC), Surveillance and Security, automotive applications such as e-Call, Toll Collect, Fleet Management and Anti Theft Systems.

**N711: GSM/GPRS/EDGE reference design**
- **Description**: The N711 modem design combines baseband processor, RF transceiver, antenna switch and power management components to support quad-band GSM/GPRS/EDGE functionality including voice, enhanced data and SMS capabilities.

**N721: GSM/GPRS/EDGE/HSPA reference design**
- **Description**: The N721 modem design combines baseband processor, RF transceiver, antenna multiplexer and power amplifier components to support quad-band GSM/GPRS/EDGE/ HSPA functionality including voice, high-speed data and SMS capabilities.
- **Typical applications**: High-speed wireless data cards, smart-phones, connected navigation systems, PDAs and high transmission bandwidth consumer applications such as mobile internet access and streaming video.

For more information about u-blox’ wireless solution reference designs, please visit the “Wireless solutions” section of our website, www.u-blox.com.
Support worldwide offices provide you with GPS and wireless technology experts to ensure the success of your designs (see list of our global locations on page 68). In addition, u-blox provides comprehensive interactive support software for evaluation, design-in, testing and performance visualization of all its GPS receiver products. Based on a sophisticated graphical user interface, the software supports both Windows and Windows Mobile platforms and may be downloaded free-of-charge from u-blox’ website.

u-blox also provides easy to use evaluation kits which make evaluation of our KickStart acquisition and SuperSense® tracking technologies as well as precision timing and wireless solutions quick and simple. The kits may be ordered directly from u-blox.

Additionally, u-blox provides our customers with a complete set of technical documentation and support firmware supporting all u-blox based products including:

- Datasheets
- Application Notes
- System Integration Manuals
- Protocol specification
- Module firmware and USB device drivers
- GPS tutorial
- Field test reports
- Product change notifications

Documentation and software are available free-of-charge via our website. Evaluation kits and reference designs can be ordered from our online shop on our website www.u-blox.com.
u-center GPS evaluation software

u-center GPS evaluation software provides a powerful platform for product evaluation, configuration, testing and real-time performance visualization of u-blox GPS receiver products. u-center provides AssistNow client functionality for A-GPS services. Its unique flexibility makes u-center the ideal evaluation tool through the entire system integration process.

Hardware platforms
IBM compatible personal computers (PCs) running Windows 2000, Windows XP or Windows Vista.

Configuration and control options
u-center provides a convenient means to configure the GPS receiver, to save customized configuration settings in the GPS receiver Flash EPROM and to restore factory settings if needed. Toolbar buttons are available to control settings such as to force cold, warm and hot starts.

Features
- Camera view: photographic data can be stored in the log file together with the navigation data and later be replayed in the application
- Exports data files to Google Earth and Google Maps
- Supports NMEA and u-blox UBX binary protocol
- Integrated AssistNow A-GPS client functionality supports AssistNow Online and Offline shortens Time-To-First-Fix (TTFF)
- Extensive GPS configuration and control options
- Connectivity: Bluetooth, UART, USB and other interfaces to connect to GPS receiver

Benefits
- Interactive and easy to use
- Supports all u-blox GPS receivers
- Access to all controls and output messages
- Enables comparative performance analysis of GPS receivers that output NMEA messages

Visualization
Docking views with real-time cockpit instruments and satellite status charts allow easy observation of the static and dynamic behavior of the GPS receiver.

To visualize positions and traveled routes on maps, easy-to-use interactive functions are provided that enable importing a map file and entering three geodetic positions in order to calibrate the map so the measured positions are placed correctly on the map.

Data analysis
u-center allows the user to choose from a large number of parameters to create tabular views, 2D charts, histograms and compute statistics. Tabular views can be copied and inserted into commercial software like Microsoft Excel spreadsheets.

Ordering information
u-center is available free of charge and can be downloaded from our website.

u-center mobile GPS tool

u-center mobile is the ideal tool to evaluate u-blox GPS technology, GPS products and AssistNow A-GPS in the field, particularly with GPS integrated in mobile devices and consumer products. Running on Windows mobile based PDAs, and using Bluetooth, USB or UART connectivity, u-center mobile provides a highly flexible platform to configure, visualize and analyze GPS performance in real-time.

Data such as recorded log files and maps can be exchanged between u-center mobile and u-center in both directions.

Benefits
- Interactive and easy to use
- Supports all u-blox GPS receivers.
- Access to all controls and output messages
- Connectivity: Bluetooth, UART, USB and other interfaces to connect to GPS receiver

Features
- Supports NMEA and u-blox UBX binary protocol
- Integrated AssistNow A-GPS client functionality supports AssistNow Online and Offline shortens Time-To-First-Fix (TTFF)
- Extensive GPS configuration and control features
- Structured and graphical data visualization in real-time:
  - Satellite summary view (SV)
  - Navigation summary view
  - Compass, speedometer, clock, altimeter
  - Chartview of any two parameters of choice
- Data recording and playback functionality
- Format of log files is compatible with u-center

Supported platforms
- Microsoft Windows Mobile for Pocket PC (Personal digital assistants)
  Version 2002, 2003 or newer
- Windows Mobile 5.0
- Microsoft Windows Mobile Standard SDK available upon request

Ordering information
u-center mobile for Pocket PC is available free of charge and can be downloaded from our website.
EVK-5
u-blox 5 Evaluation Kits

Product description
The EVK-5P Evaluation Kit with SuperSense®, EVK-5H Evaluation Kit with KickStart, and EVK-5T Precision Timing Evaluation Kit, make evaluating the high performance of u-blox 5 positioning engines simple. The built-in USB interface provides both power supply and high-speed data transfer, and eliminates the need for an external power supply. u-blox 5 Evaluation Kits are compact, and their user-friendly interface and power supply make them ideally suited for use in laboratories, vehicles and outdoor locations. Furthermore, they can be used with a PDA or a notebook PC, making them the perfect companion through all stages of design-in projects.

Highlights
- Easy to use
- Extensive visualization and evaluation features
- Supports AssistNow Online and AssistNow Offline1 A-GPS services
- 1 USB port, 1 UART port
- Power supply and data transfer over USB (USB V2.0 compatible)

Kit includes
- Compact 74 x 54 x 24 mm EVK-5 unit
- USB cable
- Active GPS antenna with 5 m cable
- CD-ROM containing:
  - u-center and u-center mobile software
  - USB driver software
  - Extensive documentation

1 Requires firmware upgrade, contact u-blox for information

Experience u-blox 5 performance after just three simple steps
Step 1: Connect the GPS antenna
Step 2: Use the USB cable to connect the Evaluation Kit to a PC
Step 3: Install the u-center evaluation software

System requirements
- PC with USB interface
- Operating system: Windows 2000 or above, Linux
- USB drivers are provided in the Evaluation Kit CD

u-center GPS evaluation software
EVK-5 Evaluation Kits include u-center, an interactive tool for configuration, testing, visualization and data analysis of GPS receivers. It provides useful assistance during all phases of a system integration project.

Configuration
u-center provides convenient means to configure the GPS receiver, store customized configuration settings in the GPS receiver and restore factory settings.

Visualizaion
u-center allows you to visualize GPS traces on top of picture files of maps of any scale. A quick look at a trace on a map reveals a lot about the GPS receiver’s performance. Simply open a picture file and enter map calibration information with few mouse clicks to start visualization.

Support products
EVK-5P u-blox 5 Evaluation Kit with SuperSense® suitable for LEA-5A, LEA-5M, NEO-5M
EVK-5T u-blox 5 Evaluation Kit with Precision Timing suitable for LEA-5T

Ordering information
EVK-5H-0 u-blox 5 Evaluation Kit with KickStart
EVK-5P-0 u-blox 5 Evaluation Kit with SuperSense®
EVK-5T-0 u-blox 5 Evaluation Kit with Precision Timing

Sub connector pin description
The 9 pin D-SUB female connector is assigned as follows:

<table>
<thead>
<tr>
<th>Pin</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DCD, DataCarrier Detect, GPS timepulse output</td>
</tr>
<tr>
<td>2</td>
<td>TXD, GPS Transmit Data, serial data to DTE</td>
</tr>
<tr>
<td>3</td>
<td>RXD, GPS Receive Data, serial data from DTE</td>
</tr>
<tr>
<td>4</td>
<td>DTR, Data Terminal Ready, GPS ExtInt input</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
</tr>
<tr>
<td>6</td>
<td>DSR, Data Set Ready, GPS timepulse output</td>
</tr>
<tr>
<td>7-9</td>
<td>not connected</td>
</tr>
</tbody>
</table>

Testing and analysis
Cockpit type instruments, a wide range of tabular and graphical viewing features as well as statistics functions are there to make testing and analysis functions easy to accomplish.
**EVK-G25P**

**Quad Band GSM/GPRS Evaluation Kit**

**Product description**

The EVK-G25P Quad Band GSM/GPRS Evaluation Kit makes evaluating u-blox LEON-G100/G200 modules simple. This kit is practical and easy to use, and its user-friendly interface and USB connectivity make it ideally suited for all stages of design-in projects.

The EVK-G25P also comes with a built-in u-blox 5 GPS receiver module, giving designers the flexibility to either test GSM/GPRS functionality alone or to integrate it together with u-blox GPS technology. For evaluating Assisted-GPS (A-GPS) a u-blox AssistNow A-GPS client is embedded in the GSM firmware stack, providing users with the option of integrating and testing our license-free A-GPS solutions.

**Highlights**

- Full feature quad-band GSM/GPRS, class 10, with embedded TCP/IP stack
- Built-in u-blox 5 GPS module for evaluating u-blox’ GPS and AssistNow Online and AssistNow Offline A-GPS solutions

**Block diagram**

- Access to GSM via USB port (data communication and debug port)
- Access to all LEON signals via 50-pin data connector (connector cable not included)
- Powerful evaluation and configuration tools

**Kit includes**

- Evaluation board with LEON-G200 GSM/GPRS and u-blox 5 SuperSense® GPS receiver module
- Audio headset
- USB cable
- GSM and GPS antennas
- Power adapter
- CD-ROM containing:
  - Evaluation software
  - USB driver software

**Simple set-up**

Experience u-blox wireless technology in just five simple steps:

- **Step 1:** Connect the GSM and GPS antennas and headset
- **Step 2:** Insert SIM card into SIM holder
- **Step 3:** Use the USB cable to connect the Evaluation Kit to a PC
- **Step 4:** Connect to power supply
- **Step 5:** Install the evaluation software and USB driver

**System requirements**

- PC with USB interface
- Operating system: Windows
- USB drivers are provided in the Evaluation Kit CD
- SIM card with GPRS activated for data transfer

**Evaluation software**

EVK-G25P Evaluation Kits include interactive tools for configuration, testing, visualization and data analysis of u-blox wireless and GPS modules. They provide useful assistance during all phases of a system integration project.

**Ordering information**

<table>
<thead>
<tr>
<th>EVK-G25P-00S</th>
<th>Quad Band GSM/GPRS Evaluation Kit</th>
</tr>
</thead>
</table>

11 x 13 cm
At the core of our philosophy is our passion to deliver high-performance, small-profile, low power, and cost-effective embedded solutions to our OEM customers. Whether for professional applications such as fleet management or asset tracking, vehicle services such as eCall, anti-theft systems and road pricing, or consumer geotagging for cameras, u-blox has the right technology to deliver the sensitivity, connectivity, noise immunity, low-power and compact size required by today’s and tomorrow’s demanding applications.

Advanced technology features

Anti Jamming
Through advanced digital filtering algorithms, u-blox GPS receivers may be embedded in close proximity to RF noise sources: in mobile computers, mobile phones, PNDs, and automotive dashboards. Read more on Page 54.

Capture & Process
u-blox’ patented software technology has resulted in extremely low-power, point-and-shoot geotagging products for portable consumer devices such as cameras. The solution facilitates sorting, finding, and sharing of media such as photos and videos based on the location where it was captured. Read more on Page 56.

Dead Reckoning
When GPS signals are blocked (e.g. in tunnels or indoor car parks) u-blox’ Dead Reckoning (DR) technology allows uninterrupted vehicle navigation based on heading and distance data provided by external sensors. Read more on Page 58.

KickStart
u-blox’ proprietary KickStart technology delivers the world’s fastest acquisition of GPS satellite signals even in difficult environments such as indoor locations and deep urban canyons. Read more on Page 60.

Precision Timing
u-blox’ GPS clock synchronization technology allows globally distributed computer and telecom systems to synchronize their clocks continuously and cost-effectively. Read more on Page 62.

SuperSense®
u-blox’ SuperSense® technology has become the world’s de-facto standard for unbeatable GPS tracking performance. Combining high-sensitivity with low-power consumption, SuperSense® delivers a seamless GPS tracking experience in challenging environments where GPS signals are extremely weak. Read more on Page 64.
A critical factor when selecting components for a GPS system is the receiver’s immunity to external noise, or “jamming.” The ability to lock onto typically faint GPS signals in the presence of noise generated from other electronic devices has a large influence on the system’s ability to provide correct location data.

The problem
A main reason that jamming is an issue with any GPS receiver is that the signals coming from satellites are extremely weak. Satellites transmit with a power output of roughly 30 W and are typically 20,000 km away. In fact, a typical satellite signal, when acquired outdoors, is in the range of −120 dBm (1x10−15 W). Being inside an average residential building can add 20 or 30 dBm of additional attenuation. With such a weak signal, other signals in the same GPS frequency band don’t need to be very strong to interfere with or even override satellite GPS signals.

Jamming signals can come from ordinary commercial electronic appliances. You might expect for consumer electronics that the FCC, CE and other agencies would regulate against interference of GPS systems. Unfortunately, that is not the case; regulations don’t address signals at frequencies higher than 1 GHz (GPS carriers operate at 1.575 GHz), and even allow many orders of magnitude stronger than GPS signals.

The u-blox solution
If unintentional jamming signals are unavoidable, we have to learn to live with them. Manufacturers of GPS equipment and chipsets take a variety of approaches to combat jamming signals via SAW and anti-aliasing filters to attenuate out-of-band signals.

However, the issue of dealing with in-band interference signals remains. u-blox employs several particularly effective proprietary techniques: analog RF signals are digitized to 5 bits of resolution (thus giving 30 dB of dynamic range) in contrast to other receivers which typically digitize to only 1, 1.5 or perhaps 2 bits (and thus only up to 10 dB of dynamic range). With this extra dynamic range, we are able to apply a proprietary intelligent filtering method based on a bank of on-chip digital filters whose configuration can be dynamically changed under software control.

A proprietary adaptive filtering technology allows the u-blox 5 GPS positioning engine to overcome jamming signals up to 25 dB stronger than conventional GPS receivers. This technique sweeps across the GPS receiver band looking for the strongest signal peaks, and for each it performs statistical analysis to determine if it is actually a satellite signal. Upon finding a jamming signal, the algorithm puts it into a list so that this signal is subsequently blanked out. If a signal for some reason can’t be removed in this way, the technique builds up a table of thresholds; if a real GPS signal drops below this threshold, the detection algorithm is very cautious about using it so the receiver doesn’t track false signals.

This special, field-tested jamming-mitigation method requires considerable processing power, which u-blox 5 based products supply with an integrated ARM® processor. This proprietary adaptive digital filtering technology allows the u-blox 5 GPS positioning engine to overcome jamming signals up to 25 dB stronger than conventional GPS receivers can withstand. The result is the most sensitive and reliable GPS receiver technology available.

For more information, please visit our website www.u-blox.com and download our Anti-Jamming Whitepaper from the Technology section.
u-blox’ patented GPS Capture & Process software technology enables mobile products to instantly capture a location using just a few millijoules of power. This is especially attractive for applications such as photo geotagging in cameras where users just want to point and shoot, and not waste precious time and battery power waiting for a conventional GPS position fix. The following sections highlight the technical principles underpinning Capture & Process and how it differs from real-time GPS. While the technology can be used in many mobile applications we will for the purposes of illustration describe its use within a camera.

How it works
In contrast to real-time GPS receivers which can take a long time to establish a position fix, GPS Capture & Process provides a means of immediately capturing location data in a fraction of a second. Uniquely, it achieves this by separating the GPS signal processing into two distinct steps:

- **Capture:** the raw, unprocessed output of a GPS front-end is stored locally in the camera
- **Process:** The unprocessed capture data and associated photos are uploaded to a PC/Mac where the GPS Software processes the data and quickly calculates a position fix.

**Capture**
To perform a capture, a device requires a low-power GPS radio, an antenna and some memory. To initiate the capture the GPS radio is turned on for a short period of time, typically less than 200 ms. During this brief period the raw GPS Intermediate Frequency (IF) signal is captured, stored, and the GPS radio is turned off. No baseband processor is required, so the task is fast and consumes a negligible amount of the camera’s battery power.

**Process**
Some time later, the unprocessed GPS data is transferred to a PC or MAC and the u-blox GPS software is run. Initially, it identifies the time the photo was taken and sends a request to a u-blox server for the corresponding historical satellite data (“ephemeris”). When this data is returned, the software combines this with the raw GPS data to calculate a position fix. The whole process requires less than a second per photo.

Adding geotagging capability to a camera
The GPS Capture & Process capability for geotagging can be added to a camera with relatively little impact on the camera hardware or firmware. As cameras already have a processor and flash memory, only an additional GPS radio and an antenna are required, as illustrated below:

In summary the key benefits of Capture & Process are:

- **Ultra-fast location capture**
  GPS signal data is captured on-demand in less than 200 ms – no waiting for acquisition of satellite orbital data necessary. Photos and location are captured simultaneously in an instant

- **Extremely low power solution**
  The GPS radio is on for less than 200 ms per capture and so consumes just a few millijoules of power

- **Fast time-to-market**
  Complete end-to-end, market proven architecture with off-the-shelf reference designs. Geotagging solutions are available for integrated cameras and camera/datalogger accessories

- **Fast PC processing**
  u-blox GPS software is optimised for Windows and Mac and can typically compute a position fix from a capture in 0.4 s

For more information, please visit our website [www.u-blox.com](http://www.u-blox.com) and download our Geotagging Whitepaper from the Technology section.
Dead Reckoning

GPS positioning works well when at least four satellites are within a GPS receiver’s line-of-sight. However, in urban environments where the accuracy of GPS navigation is crucial, the view to the sky is often obstructed, or high-rise buildings reflect GPS signals causing severe multipath effects, degrading the quality of GPS. In tunnels or underground parking garages, GPS positioning may not work at all.

100% Coverage
Dead Reckoning principle:
- Absolute GPS position fix is required as starting point
- Incremental calculation of next points using e.g.
  - Distance traveled
  - Turn rate (angular change)
- Calibration is achieved with a short drive and the gyroscope properties without the need for user intervention. Calibration is performed automatically using an integrated calibration mechanism that detects the scaling factor of the tachometer (pulses per kilometer traveled) and the gyroscope properties without the need for user intervention. Calibration is achieved with a short drive under good GPS reception conditions.

DR using gyroscope and tachometer
Using a gyroscope and odometer pulses from a tachometer make this solution independent of the vehicle data bus and therefore ideal for after-market applications.

Dead Reckoning (DR) enables 100% road coverage. GPS positioning information is supplemented by heading and distance data provided by additional sensors. These sensors can be electrically connected to the GPS receiver or the sensor readings can be obtained through the vehicle data bus. When GPS satellites are out of sight, GPS location is extrapolated using distance and angle information from the sensors. This results in accurate positioning even when the GPS signal is impaired or absent. DR not only allows full coverage in indoor car parks, tunnels and underpasses but also effectively eliminates the impact of multipath effects in urban canyon environments.

New York
When one thinks of New York, one immediately pictures Manhattan. The island's dense population of skyscrapers, massive urban canyons and numerous tunnels make GPS navigation highly challenging. In such environments, GPS receivers on the move face severe multipath effects (caused by signal reflections from buildings), signal attenuation and a frequently changing constellation of visible satellites.

100% coverage
In this kind of environment, Dead Reckoning’s use of a gyroscope and speed information is vital to maintain uninterrupted, accurate navigation in conditions where one cannot rely on GPS reception alone.

Positioning accuracy
When GPS reception is interrupted upon entering a tunnel, Dead Reckoning functionality takes over and tracks the vehicle’s location reliably, even through the long Holland Tunnel under the Hudson River, as shown in the examples below. Thanks to our receivers’ excellent reacquisition performance, GPS navigation is back up immediately after leaving the tunnel.

Essential uses
- Navigation
- Fleet management
- Personal and homeland security
- Road pricing
- Emergency Call (eCall)
u-blox’ proprietary KickStart technology delivers the world’s fastest acquisition of even the faintest GPS satellite signals. Based on a massively parallel search architecture, all u-blox’ GPS receiver products implement optional and complementary technologies to achieve the right cost/performance trade-off for your application:

- standard products with low-cost crystal: for cost sensitive, mass market products
- with KickStart and TCXO: for higher-performance applications
- with KickStart, TCXO, and AssistNow service, top-of-the-line GPS performance can be achieved with the world’s fastest Time-To-First-Fix of less than 1 second

With KickStart, the benefits to manufacturers of GPS products are clear. Your products will:

- deliver GPS services faster and more reliably than your competitors
- demonstrate superior ability to find and lock onto GPS satellites, even in the most demanding environments: cities, and indoors
- reliably operate with small antennas allowing sleeker and more compact designs (i.e. PNDs, Smartphones)
- be suitable for covert installations (i.e. for security devices, asset tracking and vehicle recovery)

Compare the performance of KickStart yourself with evaluation kits EVK-5H (without KickStart) and EVK-5P (without KickStart).

Benefits

- Ultra fast acquisition, even in weak signal environments
- High performance, even with smaller antennas
- Enables covert installations

Products with KickStart

- u-blox 5 single chips and chipsets

Applications

- Portable devices such as PNDs and smartphones
- Security devices and stolen vehicle recovery products with covert antenna installation

KickStart performance: GPS on dashboard

Personal Navigation Devices (PNDs) or GPS-enabled mobile phones equipped with standard (small) antennas often take several minutes to calculate a first position fix, leaving users waiting until the navigation device can establish a position to start navigating. KickStart ultra-fast acquisition technology enables a GPS receiver to establish a position within seconds, so users can immediately benefit from their GPS application, as illustrated in the test below.

- GPS navigation
- GPS acquisition of satellites

KickStart performance: GPS in glove compartment

Stolen vehicle recovery products or asset tracking applications, typically fitted in covert locations of a vehicle such as the glove box or under the car seats, require special technology to receive weak signals and to calculate a position under these most challenging conditions. GPS receivers equipped with KickStart technology are able to calculate a first position fix within seconds, even in the harshest signal environments, as illustrated in the field-test below.

- GPS navigation
- GPS acquisition of satellites

Above, you see the performance of a KickStart GPS receiver, placed on a vehicle’s dashboard, performing a cold start. Within very few seconds, the GPS receiver establishes a position. This performance is ensured even after long system outages.

Above, you see the performance of a GPS receiver without KickStart. A GPS receiver without KickStart requires slightly longer to establish a position fix.

Above, you see a KickStart GPS receiver in a car glovebox performing a cold start. Despite the weak signal conditions, the receiver’s ultra-fast weak signal acquisition enables it to establish a position within a few seconds.

A GPS receiver without KickStart is still able to establish a position but takes substantially longer to do so, due to the covert location of the GPS receiver, which undermines signal strength.
**Precision Timing**

**GPS for high Precision Timing applications**
Precise time synchronization is the essence of modern wireless communication systems.

**Why is GPS crucial for global stock markets?**
Because GPS is the heartbeat of global computer networks. Only GPS can provide time with nanosecond accuracy, regardless of where a computer within the network is located.

**Why is the synchronization of computer networks important?**
Because it is the difference between a stock order from Sydney being executed before or after one entered in New York. A single millisecond error can result in a loss (or gain) of millions of dollars.

GPS time is not only useful for banks and stock exchanges; it is also used for the synchronization of electric utilities, mobile communication networks such as UMTS, CDMA and WiMAX. It is also used in geology for oil field exploration.

**u-blox Precision Timing solutions**
-u-blox offers dedicated solutions for Precision Timing applications. Their main features include:
- GPS-synchronized time-pulse output: Standard output rate is 1 Hz but u-blox receivers can be configured to update at any specific frequency, from 0.25 to 1000 Hz.
- High accuracy: Our solutions boast an accuracy of 30 nanoseconds Root Mean Square (RMS); 15 nanoseconds (RMS) when the quantization error of the timepulse is compensated in post-processing.
- Single satellite timing and navigation functionality: Our timing receivers maintain timing capabilities even with only one satellite in view. This means that time can be output even under adverse signal conditions or in environments with poor sky visibility. Flexible antenna placement options in turn reduce installation costs.
- Self survey mode for determining accurate static position: This invaluable feature allows for a receiver to determine its position autonomously and accurately, without the need for a costly manual surveying. By establishing an accurate static position, the timing receiver is able to optimize its algorithms for the output of a highly accurate time.
- Employs T-RAIM algorithms to detect faulty GPS measurements.
- Fast acquisition and AssistNow support helps to bring down installation costs as the antenna does not need to be placed at a location with direct sky view such as a building rooftop.
- A built-in time mark and counter unit provides a globally synchronized time stamping and time-measuring functionality useful in applications such as seismic sensors or applications with wide-area synchronization needs.
- Our 17 x 22.4 mm LEA-5T modules enable integration into small-sized applications. The module’s SMT pads allow for fully automatic assembly processes with standard pick-and-place equipment and reflow soldering. These features make LEA-5T modules ideal for cost-efficient, high-volume production.
- The LEA form factor ensures that customers can easily migrate from one GPS platform to the next, without having to modify the PCB.

**Precision Timing performance: LEA-5T GPS module**
The time synchronization of base stations, computer networks or electric utility companies requires accurate timing. Important is not so much the typical accuracy value but rather the reliability and repeatability of the timing output. In other words, it is the statistics behind the accuracy figure, which reveal the quality of a GPS timing receiver. Only a GPS receiver with a dedicated timing mode, such as u-blox’ LEA-5T timing receiver, can achieve a low standard deviation of the time accuracy, as seen in the test below.

The histogram above shows the time accuracy frequency distribution of the LEA-5T, measured over 24 hours. For this test, the GPS receiver was placed on a building rooftop and its accuracy was measured without compensating the quantization error. The graph illustrates the very low standard deviation and maximal error of u-blox timing receivers.

The timepulse signal is derived from the system clock of the GPS receiver. The quantization error is the difference between the true (analogue) time value and the approximative digital value of the timepulse output, caused by the alignment to the system clock. One can further improve the receiver’s time accuracy by compensating the quantization error, which the receiver determines and outputs via a serial interface. The resulting accuracy when compensated can then be as good as 13 nanoseconds.
SuperSense® indoor GPS

u-blox’ SuperSense® technology has become the world’s de-facto standard for unbeatable GPS tracking performance. Combining high-sensitivity with low-power consumption, SuperSense® delivers a seamless GPS experience in challenging environments where GPS signals are extremely weak, and with no direct view to satellites. Available on all u-blox 5 based chips, modules and cards, SuperSense® empowers GPS devices with reliable and uninterrupted operation, and is especially suited for battery-operated applications and compact devices where small antenna and covert installation are critical.

SuperSense® provides these important benefits to manufacturers of GPS devices:

Products with SuperSense®
- All u-blox 5 chips and modules come with built-in SuperSense® indoor GPS technology
- Selected ANTARIS®4 Modules: NEO-4S, LEA-4H, LEA-4S, LEA-4T, TIM-4H and TIM-4S

Performance with u-blox 5
- Tracking and navigation: –160 dBm
- Reacquistion: –160 dBm

SuperSense® benefits
- Extended terrain coverage
- Antenna flexibility
- Enables covert antenna applications

Key features
- Industry-leading GPS sensitivity for reliable tracking performance in demanding environments: indoors, under bridges, and embedded in vehicles or containers
- High positioning accuracy
- Low-power consumption for extended operation with smaller batteries
- Reliable operation with small antennas allowing sleeker and more compact designs (i.e. PNDs, Smartphones)
- Ideally suited for covert and embedded installations (i.e. for security devices, fleet management, asset tracking and vehicle recovery)

Performance with ANTARIS®4
- Tracking and navigation: –158 dBm
- Reacquisition: –148 dBm

SuperSense® applications
- Handheld devices
- Integrated car navigation devices
- Vehicle tracking

SuperSense® Performance: Getting around Waterloo Station, London, U.K.

Waterloo is the UK’s largest station and is built of Portland Stone and glass. It is also one of the world’s most frequented train stations with more than 100,000 commuters and hundreds of trains every day. Finding one’s way in such a large space can prove quite challenging. Ordinary GPS receivers are not capable of perceiving signals indoors but u-blox SuperSense® receivers provide accurate position information despite obstructed views to satellites, enabling users to find their way around easily and accurately.

Signal to noise ratios (C/No) from different satellites measured in different locations:

Come into Waterloo Station on the Eurostar, downstairs through customs (*) and out to the IMAX... ... after a visit to the IMAX and the London Eye, back into Waterloo station to catch a train to Brighton!
Production and quality: System

u-blox strives to achieve best-in-class quality and reliability performance in all products through a systematic approach that emphasizes quality at every phase of the product life cycle including development, prototyping, product qualification and manufacturing.

Our quality management system is ISO 9001 certified, which reflects u-blox’ process driven approach to innovation. u-blox has carefully selected strategic suppliers who meet the ISO/TS 16949 standard, which was developed by the automotive industry to ensure the highest level of quality in the automotive supply chain.

Production and quality: Packaging

Chips and modules are moisture-sensitive devices. When reflow soldering, these products must be moisture-free to avoid defects that can arise under the hot temperatures used by reflow soldering machines. When soldering by hand with a soldering iron, moisture levels are not an issue.

Chips and chipsets
u-blox delivers chips packed into reels which are, in turn, packed into ESD (Electrostatic Sensitive Device) and moisture-shielding bags. Sample deliveries are packed onto trays and are also packaged into ESD and moisture-shielding bags.

Modules
Modules come in 100 unit or 250 unit reels, depending on the module. The reels are dry-sealed into ESD and moisture-shielding bags that come with detailed care instructions about moisture sensitivity levels and maximum factory floor times. Sample quantities (of less than 100 or 250 units, typically soldered by hand) are shipped in ESD-protected cartons but are not moisture-protected as moisture levels are not an issue when hand-soldering. Baking instructions must be closely observed if reflow soldering is used.

Receiver boards
Moisture is not an issue for receiver boards like the PCS-5S and RCB-4H since they are not soldered.

Shipping
Europe, Middle East, Africa and Asia Pacific regions: Samples are shipped from our headquarters in Switzerland and can be purchased directly from our online shop. Modules are sent directly from our warehouse in Austria (an EU member country) and chipsets are sent from the Philippines.

Americas: All shipments, regardless of quantity, are sent from our US sales office in Reston, Virginia, USA.

RoHS compliance
The use and disposal of six environmentally hazardous materials including lead has been banned in Europe under the EU’s ‘Restrictions on Hazardous Substances’ (RoHS) directive and the directive on ‘Waste Electrical and Electronic Equipment’ (WEEE). Since July 1, 2006, electronic components and systems must be lead-free to be traded in the EU.

All u-blox 5 ICs listed in this catalogue are ‘Green’, i.e. RoHS compliant and halogen-free.

For further information, please visit our website.
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